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MORAXELLA. THE STANDING IN NOMENCLATURE OF VARIOUS PROPOSED NAMES

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In a recent paper on Moraxella (Henriksen 1960) the latest (1957) edition of Bergey's Manual was used as the starting point, and no attempt was made to determine whether the names used in the Manual are correct. In connection with this paper the editor of this Bulletin suggested that a re-examination of the early literature on this genus was desirable in order to clarify some obscure points of nomenclature, and to check the correctness of the names now in common use. The present paper is an attempt to do this.

Generic names

Morax (1896), Axenfeld (1897) and Petit (1899) used only vernacular names to designate the organisms described by them. Species now placed in the genus Moraxella were placed in the genus Bacterium by Chester (1897) and by Lehmann and Neumann (1899), and in Bacillus by Eyre (1900). The generic name Bacterium was placed by international agreement in the list of genera rejicienda and by similar agreement the type species of the genus Bacillus was designated as Bacillus subtilis, a rod producing endospores. MacNab (1904) used the generic name Diplobacillus for organisms now placed in Moraxella. This name might well have been legitimate and appropriate were it not for the fact that Weichselbaum (1887) had already used this generic name in a combined generic-species description of an unrelated organism, Diplobacillus brevis endocarditidis. Weichselbaum's paper where this name is proposed includes a description which seems to be quite adequate according to the

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standards of those days, although it is insufficient to recognize the organism today. The name given to the species is not "a binary combination consisting of a generic name followed by a single specific epithet" and hence not validly published (Rule 14a(1)). The question next arises whether in a combined genus-species description in which the species name is not validly published the generic name may be validly published. The question next arises whether in a combined genus-species the whole combination is illegitimate, or only the specific epithet, but not the generic name.

In favour of the former alternative it may be said that since only a single species was described, it would be unreasonable to reject the specific epithet and to accept the generic name, since this would leave us with a genus without any validly named species.

In favour of the second alternative it may be said that the validity of publication of generic names is regulated by Rule 13 only, and that the function of Rule 14a is to prevent the introduction of an unacceptable specific epithet or of an illegitimate combination, but not to reject otherwise acceptable generic names. The correct interpretation of Rule 14a in a case like this might be that the specific epithet would have to be changed in order to make the name validly published, whereas there could be no objection to the generic name if combined with an acceptable epithet. A simple way of handling such a difficulty would have been to drop one of the two words in the epithet, as has been done in many similar cases. But since nobody has ever again identified this species, there has been no opportunity to do this. It seems to me that such an interpretation of the rules is reasonable, and that Diplobatillus Weichselbaum should be considered as validly published and Diplobacillus MacNab as a later homonym.

As for Diplobacillus Weichselbaum, organisms belonging to this genus have never again been identified, and Weichselbaum's description is so sketchy that it is highly improbable that such organisms ever will be identified. In view of this it would be reasonable to place the name Diplobacillus Weichselbaum 1887 in the list of nomina rejicienda as a nomen dubium.

In view of the complex nature of this problem it is suggested that this is a matter for the Judicial Commission to consider and that opinions are desirable on the questions

whether Diplobacillus Weichselbaum 1887 should be rejected as a nomen dubium, and Diplobacillus MacNab 1904 as a later homonym.

Practical considerations speak strongly in favour of such a solution, since Diplobacillus has not been in general use as a generic name for a long time, and considerable confusion might arise from its reintroduction.

No other generic name seems to have been introduced until Holland (1920) proposed the inclusion of these organisms in the genus Haemophilus. This proposal appears to have been reasonable at that time, and no formal objection can be raised against it. In view of what has already been said, it may be the first legitimate generic name used for these organisms.

Lwoff's (1939) proposal to separate these organisms from Haemophilus and to create the new genus Moraxella, was supported by convincing arguments, as he showed that neither morphology nor growth requirements indicated relationship between these organisms and Haemophilus. If the generic name Diplobacillus MacNab is considered as unavailable, no objection can be raised against Lwoff's proposal, and Moraxella Lwoff 1939 consequently is the correct generic name.

Specific epithets

Chester (1897) was the first to propose a formal name, Bacterium conjunctivitis, for the type species. Two objections can be raised against this name. The first, that the epithet was grammatically incorrect (conjunctivitis instead of conjunctivitidis), might have been met by a simple correction. Indeed Chester himself (1901) made the correction in 1901. The second objection is more serious, namely that Chester gave the same name to two different organisms, one being Bacterium conjunctivitis (Morax), and the second, — described on the following page of the same report—being Bacterium conjunctivitis (Koch-Kartulis). The identity of the latter organism is highly questionable. There is little doubt that the bacteria seen by Koch (1883) in secretions from cases of catarrhal conjunctivitis in Egypt, were the organism named Bacillus aegyptius by Trevisan (1889) and now known as Haemophilus aegyptius, which requires both the X- and V-factors. The cultures which Kartulis (1887)

obtained on plain agar from similar cases, must have been some other, unknown organism. Probably the bacteria which grew in his cultures were not the same as he had seen in direct smears of the secretions. It seems, therefore, that the name Bacterium conjunctivitis, as applied to the organism described by Kartulis, and erroneously ascribed to both Koch and Kartulis, should be rejected as a nomen confusum under Rule 24g (Buchanan et al. 1958).

On the other hand Rule 24d states: "When an author simultaneously publishes the same new name for more than one group, the first author who adopts one of them, or substitutes another name for one of them, must be followed." Lehmann and Neumann (1899) were the first to give the Morax-Axenfeld organism another name, Bacterium duplex, and accordingly duplex is a correct specific epithet and remains so, unless some other epithet is conserved. Migula (1900), on the other hand, was first to adopt the name proposed by Chester, although in corrected form, for one of the species, namely Bacterium conjunctivitidis (Koch) Migula. Thus the situation with respect to this name is perfectly clear.

Eyre (1900) proposed the name Bacillus lacunatus at a scientific meeting in July, 1898, but the proposal was not validly published until 1900. Furthermore, it has been suggested (Buchanan 1959) that this name is a later homonym of Bacillus lacunatus Wright 1895, and this view appears to be correct. Wright's publication (1895) of the name was valid and it was accompanied by a rather detailed description, although even in this case the species may be unrecognizable today. The fact that the generic name is illegitimate in both cases and that the two organisms apparently were unrelated can probably not alter the conclusion that Bacillus lacunatus Eyre 1900 is a later homonym.

It might be said that this conclusion is unfortunate. The epithet lacunata appears to have been generally accepted and has been used in several editions of Bergey's Manual as well as in most of the recent literature. The adoption of the epithet duplex could cause some confusion. It might, therefore, be a good solution to conserve the epithet lacunata. If lacunata is to be conserved, it will have to be decided whether the epithet should be ascribed to Eyre, who published an illegitimate name, or to Holland, who appears to have been the next author to adopt it, or to both (M. lacunata Holland

1920 ex Eyre 1900?), or to Lwoff. It seems that the best way to handle these difficulties will be to request an opinion of the Judicial Commission.

The situation is simpler with respect to the other species. Petit's "diplobacille liquefiant" was first given a latin name, Diplobacillus liquefaciens, a literal translation of the name used by Petit, by MacNab (1904). According to the rules, then, the correct name is Moraxella liquefaciens (MacNab 1904) Murray 1948. The epithet duplex proposed by Lwoff (1939) seems to be illegitimate as a later homonym of duplex Lehmann et Neumann 1899.

Scarlett (1916) named the species described by him Bacillus duplex non liquefaciens. Oliver and Wheery (1921) changed this name slightly to Bacterium duplex non-liquefaciens without clearly indicating that they were proposing a new name. These ternary and binary epithets are contrary to the rules. Furthermore, if this organism constitutes a separate species, the epithet duplex is illegitimate. The remaining part of the epithet, nonliquefaciens, however, is acceptable. Apparently this epithet was first used by Murray and Truant (1954) and accordingly the correct name of this species is Moraxella nonliquefaciens (Scarlett 1916) Murray et Truant 1954.

The organism described by Jones and Little (1921) was not named until Hauduroy et al. (1937) proposed the name Haemophilus bovis. The correct name of this species is Moraxella bovis (Hauduroy et al. 1937) Murray 1948.

Finally, if the new sugar-fermenting organism described by Flamm is confirmed to be a Moraxella species, its correct name is Moraxella saccharolytica Flamm 1956.

Conclusions

It is proposed that the generic name Diplobacillus MacNab 1904 should be considered as a later homonym of Diplobacillus Weichselbaum 1887. If this proposal is accepted, Moraxella Lwoff 1939 is the correct generic name, and the correct names of the species are the following:

1. Moraxella duplex (Lehmann et Neumann 1899)
2. Moraxella liquefaciens (MacNab 1904) Murray 1948
3. Moraxella nonliquefaciens (Scarlett 1916) Murray et Truant 1954

4. Moraxella bovis (Hauduroy et al. 1937) Murray 1948
5. Moraxella saccharolytica Flamm 1956

Opinions of the Judicial Commission are requested on these questions:

I. Should a generic name proposed in a combined description of a genus and a species in a monotypic genus be regarded as validly published if the name of the single species described was not validly published?

II. Should the generic name Moraxella Lwoff be conserved against Diplobacillus MacNab?

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COMPARISON OF DYSENTERY BACTERIA ISOLATED AND CLASSIFIED IN THE USSR WITH CULTURES FROM FOREIGN COLLECTIONS CLASSIFIED IN TERMS OF THE INTERNATIONAL NOMENCLATURE

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For a number of years our laboratory has been carrying on studies on biology and taxonomy of Shigellae recovered in the USSR and their comparison with cultures from foreign sources.

Confrontation of type cultures from the Soviet Union collection with those from English, French and Hungarian national centers has been undertaken twice in the post-war period, in 1948 and in 1957-58.

Cultures from foreign sources, with dates on which they were received as well as dates and results of their confrontation, are listed in Tables 1, 2, and 3.

Serological types of the mannitol-negative cultures "Tiakht", "Roman", "1618", "819" and "2435"*) were compared for the first time with Shigella dysenteriae 3, 4, 5, 6, 7 in 1957. Up to that time, there had been no Large-Sachs cultures in type collections of the USSR.

The serotype of "Roman" proved to be identical to type 3; that of "1618" - to type 4; "819" - to type 5 and "2435" - to type 7. Serological analysis of Q454 (type 6) could not be achieved, this culture having been received in the R-form (Novgorodskaya, 1957). In view of a close similarity in fermentative properties (Wheeler and Stuart, 1946), the culture of "Tiakht" serotype was assumed to be identical to type 6 (Table 1).

This assumption, as well as the identity of "Roman", "1618" and "819" cultures with serotypes 3, 4, 5, have recently been supported by data from Ewing et al. (1959).

*Described and classified in the USSR in 1943-46.

The first confrontation of cultures belonging to seven Boyd-Novgorodskaya serotypes*) with Shigella boydii types 1, 2, 3, 4, 5, 6 dates to 1948, when Boyd-Novgorodskaya serotype I was shown to be identical to Shigella boydii 1; III - to S. boydii 4; V - S. boydii 2; VII - to S. boydii 5. No counterparts to our serotypes II, IV, VI were to be found among the first 6 of Boyd' s serological types (Novgorodskaya, 1952).

There were data in the literature (Ewing, 1946), however, suggesting such a close similarity of fermentative properties of Shigella Lavington etousae (designated later as boydii type 7) as to assume its identity to our serotype II (Novgorodskaya, 1957).

The truth of this assumption was confirmed in 1958, when additional Shigella boydii types 7, 8, 9, 10, 11 became available. The identity of Boyd-Novgorodskaya serotype IV and Shigella boydii 9 was also established (Novgorodskaya, 1958; 1959,) (See Table 2.)

This has been supported by Ewing et al. (1959), who also demonstrated the identity of one more of our serotypes—Boyd-Novgorodskaya VI with Shigella boydii, type 12, included in the International Classification schema in 1958. This serotype appears in the provisional Soviet classification since 1952 (Troitski, 1953).

In 1947-1958 we classified two additional serological types—VIII, IX—each being represented by a single culture as yet.

It may prove possible to identify counterparts of these serological types on receiving cultures of additional Shigella boydii serotypes, entered in the International Classification in 1958, that are not available yet in USSR collections.

Various serological types of Bacterium dysenteriae flexner, Flexner variant, were previously compared to the respective cultures, classified according to foreign schemata, by a number of investigators in USSR (O. O. Gartoch et al.). Such studies had to deal with a restricted series of cultures, notably: v, w, z, x, y (Andrewes and Inman).

As a result of these confrontations, out of 6 serotypes (a, b, c, d, e, f) three (c, e, f) proved to be counterparts to w, z, v respectively, while none were found for three (a, b, d) (Troitski, 1953).

*Described and classified in the USSR in 1943-46.

In 1957-58, when a complete set of Shigella flexneri cultures had been obtained from English, French and Hungarian national centers, comparative investigations were undertaken in our laboratory by L. D. Grinberg. It was shown that our collection of Flexner type stock cultures of the Soviet Union included members of almost all of the serologic varieties, occurring in other countries and classified conforming to the International Nomenclature as Shigella flexneri serotype 1-5. (Table 3).

The place of serotype d has not been determined and is still subject to investigation.

According to data of Ewing et al. (1959), serotype d is identified as serotype 3c.

As to serologic type a, data presented by Ewing et al. (1959) suggest its identity with var. y. It should be noted, however, that the USSR collection contains adequate reference cultures of this independent serotype.

According to the USSR classification schema, Newcastle bacilli are described as a separate variety. It is warranted by their important fermentative and serologic characteristics which separate them from Flexner bacilli on one hand, and from Boyd-Novgorodskaya bacilli, on the other (gas production, consistent fermentation of dulcitol, partial group antigenic relationships with Flexner bacilli). Our collection contains 6 out of 7 fermentative variants of this bacilli. All of them are identical as to their antigenic characteristics. Confrontation with cultures of S. flexneri type 6 from different national centers has also shown the complete serological identity of our culutres with those from foreign sources.

The designation "Newcastle" adopted in the USSR nomenclature has an historical implication, related to the description of this bacterial variant, the Newcastle type being the first fermentative variant to be described.

None of the agents of dysentery discussed above, however, belong to those occurring frequently in our country. Sonne dysentery bacilli being by far the more widespread. These are mostly represented in our collection by three biochemical types.

Xylose-fermenting Sonne cultures have been occurring more and more frequently recently.

Table 1. Results of confrontation of mannitol-negative dysentery cultures isolated and classified in the USSR in 1943-46* with Shigella dysenteriae cultures 3, 4, 5, 6, 7

Culture No.	Serologic type	Counterpart International classification	Cultures received date	Confronted, date
556	"Tiakht"	Shigella dysenteriae type 6?	March, 1957	April, 1957
25104	"Roman"	Shigella dysenteriae type 3	March, 1957	April, 1957
311	"1618"	Shigella dysenteriae type 4	March, 1957	April, 1957
32089	"819"	Shigella dysenteriae type 5	March, 1957	April, 1957
2435	"2435"	Shigella dysenteriae type 7	March, 1957	April, 1957

*not included in provisional USSR classification in 1952.

Table 2. Results of confrontation of Boyd-Novgorodskaya type cultures I-VII with Shigella boydii cultures 1-11

Boyd-Novgorodskaya type		Counterpart, International classification	Cultures received date	Confronted, date	
Culture No.	Serologic Type No.				
30	I	Shigella boydii type 1	October, 1947	April, 1948	
4830	II	Shigella boydii type 7	January, 1958	April, 1958	
4322	III	Shigella boydii type 4	October, 1947	April, 1948	
10305	IV	Shigella boydii type 9	January, 1958	May, 1958	
2012	V	Shigella boydii type 2	October, 1947	April, 1948	
				April, 1948	No counterpart identified
2469	VI			May, 1958	
2619	VII	Shigella boydii type 5	October, 1947	April, 1948	
		Shigella boydii type 3	October, 1947	April, 1948	No counterpart identified
		Shigella boydii type 6	October, 1947	April, 1948	"
		Shigella boydii type 8	January, 1958	April, 1958	"
		Shigella boydii type 10	January, 1958	May, 1958	"
		Shigella boydii type 11	January, 1958	May, 1958	"

Table 3. Results of confrontation of dysentery cultures—members of Flexner serotypes a, b, c, e, f, g—with Shigella flexneri cultures 1, 2, 3, 4, 5

Culture No.	Serological type	Counterpart, International Classification	Cultures received, date	Confronted, date
18148	a_1	None identified	October, 1957	November, 1957
7141	a_2	4aA	October, 1957	June, 1958
2344	a_3	4b	March, 1959	November, 1959
1966	b	2b	October, 1957	June, 1958
1966	b	2b	October, 1958	January, 1959
8913	c	2a	October, 1958	January, 1959
5316	c	3	January, 1958	November, 1958 May, 1959
18775	f_1	1b	January, 1958	November, 1958
122	f_2	1a	January, 1958	November, 1958
11894	g_1	5 (x+)	October, 1957	November, 1957
583	g_2	5 (x-)	January, 1958	May, 1958

CONCLUSION

We find it appropriate to present the results of comparisons of dysentery bacilli isolated in USSR with cultures classified according to the International Schema. These data may help in clarifying some of the questions riased in the paper by W.H. Ewing et al. (1959), which is the first and unique contribution to the problem made by foreign investigators.

З а к л ю ч е н и е

Мы сочли целесообразным представить материалы сопоставления дизентерийных бактерий, выделяемых в СССР, с культурами, классифицированными по международной схеме. Полагаем, что эти данные могут послужить для уточнения и разъяснения некоторых положений, изложенных в статье W.H. Ewing et al. (1959), первой и единственной пока работе зарубежных авторов, посвященной этому вопросу.

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THE TAXONOMIC STATUS OF SERRATIA PLYMUTHICA (LEHMANN AND NEUMANN) BERGEY ET AL. AND OF SERRATIA INDICA (EISENBERG) BERGEY ET AL.

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Serratia plymuthica is one of the commonly recognized species of the genus Serratia. This microorganism, first isolated by Fischer (1887), was named Bacterium plymuthicum by Lehmann and Neumann (1896) who concerned themselves with its classification. These authors showed that the characteristics of this species allied it closely with Serratia marcescens, perhaps it is quite identical. It has been given species status rather uncritically even in such recent manuals on taxonomy as that of Krassilnikov 1949 and in Bergey's Manual, ed. 7, 1957.

Inasmuch as neither the original description of Serratia plymuthica or the characterizations given by Krassilnikov (1949) and Breed (1957) are complete on the basis of present-day needs, we have studied critically the justification for the recognition of this as a distinct species.

Serratia indica (Eisenberg) Bergey et al. was first isolated in 1884 by Koch from the alimentary tract of a Java ape. The organism was not named by Koch, the binomial—Bacillus indicus Eisenberg—was given by Eisenberg (1886). The history of the discovery of this species, the nomenclature and the justification of its validity was worked out by Breed (1926).

Recently there have appeared opinions that this species is identical with Serratia marcescens, e.g., Breed (1957) thinks that it represents the R-form of S. marcescens. Davis et al. (1957), as the result of a study of 50 strains of the genus Serratia, concluded that this genus has only one species, i.e. S. marcescens.

In this contribution we are able experimentally to verify the hypothesis of Davis et al.

MATERIAL AND METHODS

We have studied 6 strains under the name of Serratia plymuthica, secured from several collections: strain 192 from Prof. J. De Ley, Brussels, strains 139 and 162 from Department of Bacteriology, Indiana University, Bloomington, Indiana, strain 183 from the American Type Culture Collection, strain 847 from Prof. van Niel, Pacific Grove, California and strain 497 from Dept. of Agric. Ottawa.

We have also studied in detail 10 strains acquired from various collections under the name Serratia indica. The origin of these strains is given in Table 1.

Table 1.

Serratia indica Strain No.	Source of Strain
305	Own isolates
T72	Research Institute of Plant Production, Prague
33 and 135	Dept. of Bacteriology, Purdue University, Indiana
Bu 209	Biol. Inst. Czech. Acad. Sci., Prague
341	W.C. Haynes, Northern Regional Res. Lab., Illinois
IZ 358	Institute of Fermentation, Sao Paulo, Brazil
447	Dept. of Agriculture, Ottawa, Canada
4002 and 4003	American Type Culture Collection

We have studied the morphological, cultural, and biochemical characteristics of strains of both S. plymuthica and S. indica, using the following methods: Gram's stain as modified by Hucker, motility was detected by the Hajna method, gelatin liquefaction was tested by Frazier's method and by stab inoculation on 15% gelatin, nitrate reduction by Gries-Illosway's agent, hydrogen sulfide by means of lead acetate strips and in modified Klinger agar (Davis et al. 1957), indole by Kovács' reagent.

The fermentation of sugars was studied in peptone water with 1% sugar, starch hydrolysis was tested by Lugol solu-

tion, and the utilization of citrate determined in Koser's and Simmons' medium. Production of acetylmethylcarbinol we ascertained by Voges-Proskauer's medium by Leifson's reagent (Methods for Pure Culture Study of Bacteria (1946)).

Production of phenylpyruvic acid from phenylalanine and growth in presence of KCN were studied by the methods recommended by the Enterobacteriaceae Subcommittee (1958). Urease we ascertained by Christensen's method (1946) and by Cowan's microtest (1952), lipase by Bulder's method (1955). Pigment production was noted on potato, nutrient agar, gelatin and on the medium recommended by Dewey and Poe (1943).

RESULTS

Serratia plymuthica

Morphology: All six strains of S. plymuthica formed small Gram-negative rods occurring individually or in groups. The size varied from 0.8-1.0 x 1.5-2.0μ. All the strains were motile.

Cultural characteristics: The colonies on nutrient agar, circular with undulate margins, slightly convex, smooth. Red pigment was produced only by the strains 183 and 847, the others were cream-colored. In nutrient broth all the strains developed intense turbidity and formed a slight sediment.

Biochemical characteristics: The results of the study of biochemical characteristics of both S. plymuthica and S. indica are given in Table 2.

Discussion. We wished to determine the taxonomic status of the species S. plymuthica (Lehmann et Neumann) Bergey et al., by testing Lehmann and Neumann's hypothesis that it might well be identical with the species S. marcescens Bizio. In a study of the morphological and cultural characteristics of S. plymuthica we found no significant differences among the six strains. Differences occurred only in pigment production (3 strains formed no pigment). The differences in biochemical characteristics were as follows: One strain did not liquefy gelatin or hydrolyze casein, 5 strains showed delayed fermentation of lactose, 2 strains fermented inulin, 1 strain fermented adonitol. We attach no importance to these differences. Other biochemical characteristics

Table 2. Results of biochemical tests with 6 strains of Serratia plymuthica and 10 strains of Serratia indica.

Test	S. plymuthica		S. indica	
	No. +	No. -	No. +	No. -
Gelatin liquefaction	5	1	10	0
Casein hydrolysis	5	1	10	0
Nitrate reduction	6	0	10	0
Hydrogen sulfide I	6	0	10	0
Hydrogen sulfide II	0	6	2w	8
Indole	0	6	0	10
Milk	6	0	10	0
Hemolysis	0	6	0	10
Glucose	6	0	10	0
Gas from glucose	6	0	5w	5
Lactose	5d	1	0	10
Sucrose	6	0	10	0
Maltose	6	0	10	0
Galactose	6	0	10	0
Fructose	6	0	10	0
Rhamnose	0	6	0	10
Mannose	6	0	10	0
Inulin	2	4	0	10
Xylose	0	6	0	10
Arabinose	0	6	0	10
Glycerol	6	0	10	0
Adonitol	1	5	10	0
Sorbitol	6	0	10	0
Mannitol	6	0	10	0
Dulcitol	0	6	0	10
Starch	0	6	0	10
Esculin	6	0	10	0
Koser's citrate	6	0	10	0
Simmons' citrate	6	0	10	0
Acetylmethylcarbinol	6	0	10	0
Methyl red	0	6	0	10
KCN	6	0	10	0
Phenylalanine	0	6	0	10
Catalase	6	0	10	0
Urease	0	6	0	10
Lipase	6	0	10	0
5% NaCl	6	0	10	0
7.5% NaCl	6	0	10	0
Pigment	3	3	10	0

Hydrogen sulfide I = lead acetate papers. w = weak.
Hydrogen sulfide II = modified Klinger's agar. d = delayed.

agree with the work of Davis et al. (1957).

Our results agree to some extent with Fischer's description (1887) in which the difference between S. plymuthica and S. marcescens is said to lie in the fact that the cells of S. plymuthica are thicker than those of S. marcescens, and that a crimson pigment is produced only by S. plymuthica. Neither these differences or those recognized by Breed seem adequate today. Breed regarded as the main difference between these species the production of gas from some sugars by S. plymuthica, especially from glucose. This is also true of S. marcescens (Bergey's Manual 1957), as was found also by Davis (1957) and by us. In our opinion it is not advisable to use the ability of the genus Serratia to produce gas from sugars as a taxonomic criterion for distinguishing species; we regard it as a variable characteristic.

Having compared the characteristics of the species Serratia plymuthica with the results of Davis et al. (1957) and with the characteristics of Serratia marcescens (in Bergey's Manual (1957) as well as with the characteristics of 68 strains studied by us, we came to the opinion that Serratia plymuthica is a junior synonym of Serratia marcescens.

Serratia indica

Morphology: All strains of Serratia indica were morphologically identical, small rods, occurring singly and in chains; size of individual cells 0.8-1.0 x 1.8μ. Cells were motile and Gram-negative.

Cultural characteristics: Colonies were round with slight undulate margins, smooth, some strains were rough. Most strains at first were creamy or slightly rose-colored, later red. In nutrient broth all strains produced turbidity and white sediment. On potato and in medium recommended by Dewey and Poe (1943) all strains were pigmented.

Biochemical characteristics: The ascertained biochemical characteristics are shown in Table 2.

Discussion. The task of our present work was to ascertain experimentally whether these strains of Serratia indica were identical with Serratia marcescens. We conclude that there are no substantial differences between the individual strains of Serratia indica studied. Some differences in results appeared in the production of hydrogen sulfide as determined by two methods. By use of the first method (lead

acetate paper strips) we found sulfide produced by all ten strains, with the second method (modified Klinger's agar) we ascertained weak production in 2 strains only. These results agree with those of other authors (Clarke 1953, Davis et al. 1957).

Certain differences between individual strains were noted in the production of gas from glucose. Five strains out of the total of 10 produced a small amount of gas. We do not attach great importance to this difference. Similar results were obtained by Davis et al. (1957).

Only a small part of our results can be compared with those recorded in the original description by Eisenberg (1886) which included morphological and cultural characteristics only. Our results agree with the characteristics recorded by Eisenberg.

Breed (1957) described Serratia indica more fully but emphasized the morphological and cultural characteristics without adequate consideration of the biochemical characteristics. He does not list the kinds of sugar that this species utilizes. On the basis of Reed's work (1937) Breed suggests that Serratia indica is probably an R-form of Serratia marcescens. Our results in part verify this hypothesis.

Krassilnikov (1949) in his Guide gives no new data about this species, he places it in the genus Chromobacterium.

We attach the greatest importance to the comparison of our work with the results of Davis et al. (1957). On the basis of the study of 50 strains of genus Serratia, these authors formulated the hypothesis that this genus has only one species. We have proved experimentally that this hypothesis is correct. We have ascertained that the characteristics of 10 strains of Serratia indica agree not only with the results of the authors mentioned above but also with the characteristics of 68 strains of Serratia marcescens, which we have also studied in detail.

SUMMARY

From our study of the morphological, cultural and biochemical characters of 68 strains received as Serratia marcescens Bizio, 6 strains as S. plymuthica (Lehmann and Neumann) Bergey et al. and 10 strains as S. indica (Eisenberg) Bergey et al., we conclude that the species

names S. plymuthica and S. indica should be regarded as junior synonyms of S. marcescens.

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LETTERS TO THE EDITOR

The following letters were forwarded for publication in this Bulletin by Dr. S.T. Cowan, London, England.

"Animal Health Research Laboratory
Cr. Flemington Rd. and Park St.,
Parkville, N. 2., Victoria

21st April, 1960

AIR MAIL

Dr. S.T. Cowan,
National Collection of Type Cultures,
Central Public Health Laboratories,
Colindale Avenue,
LONDON, N.W. 9, England.

Dear Dr. Cowan,

The FAO/OIE/CCTA* Expert Panel on Contagious Bovine Pleuro-pneumonia met recently in Melbourne to deal mainly with the laboratory aspects of diagnosis and immunization. The nomenclature of the causal organism was discussed, and complete agreement was recorded on the generic name Mycoplasma proposed by Freundt, and now incorporated in the Seventh Edition of "Bergey's Manual".

The Panel closely examined the evidence on antigenic analysis by Villemot, J.M. and Provost, A. (Rev. Elev. Méd. vét. Pays trop., 1959, 12 (4), to appear shortly), an account of which was presented by Dr. Provost. This shows the occurrence of at least 6 antigens among the strains of species of Mycoplasma examined, distributed as follows: -

Species	Antigens
M. mycoides var. mycoides	1, 2, -, 4, -, -, ?7.
M. mycoides var. capri	1, -, 3.

*Food and Agriculture Organization of the United Nations Organization; Office International des Epizooties, Paris; Commission for Technical Cooperation in Africa South of the Sahara.

M. bovigenitalium	-, -, -, -, -, 6.
M. laidlawi	1, 2, 3, -, 5, -.
M. huminis	1, 2, 3, -, 5, -.
M. gallinarum (non-pathogenic strains)	1, 2, -, 4, -, 6.

The antigenic difference between M. mycoides var. mycoides and M. mycoides var. capri thus appear to be at least as great as that between it and M. laidlawi, M. hominis and M. gallinarum; indeed, var. capri appears to share only one antigen (antigen 1) with var. mycoides. It view of this, the Panel approved of Dr. Provost's suggestion that these two micro-organisms have a claim to be regarded not as varieties of the species M. mycoides, but as distinct species, to be known as M. mycoides and M. caprae, respectively.

A resolution to this effect was passed on 26th March, 1960, and I undertook to communicate this information to you with a request that it be considered by the International Commission on Bacteriological Nomenclature.

Yours sincerely,

(A. S. Turner)
ASSISTANT CHIEF OF DIVISION"

"The Wellcome Research Laboratories
Langley Court, Beckenham, Kent

26th May, 1960

The Secretary,
International Committee on Bacteriological Nomenclature,
International Association of Microbiological Societies,
Central Public Health Laboratory,
Colindale Avenue,
London N. W. 9.

Dear Sir:

The Expert Panel on Contagious Bovine Pleuropneumonia, meeting recently in Melbourne, suggested that the causal

agent of Caprine Pleuropneumonia should be established as a new and distinct species of the genus Mycoplasma and be named Mycoplasma caprae. Since I was responsible for the view that this organism should be regarded only as a variety of the type species and named it M. mycoides var. capri (Edward, D.G. ff., J. gen. Microbiol., 1954, 10, 27; Edward, D.F. ff. and Freundt, E.A., J. gen. Microbiol., 1956 14, 197) I should like to comment on this suggestion.

The Expert Panel based their opinion on the work of J.M. Villemot and A. Provost, whose findings are of great interest. They demonstrated the importance of careful analysis of the antigenic structure of Mycoplasma species, using a number of different techniques and with particular reference to the existence of antigens common to more than one species. However, previous investigations, using antisera carefully prepared in rabbits by inoculating them with antigens grown in media enriched with rabbit serum, have demonstrated a marked species-specificity within this genus, as demonstrated by the agglutination reaction. Moreover, when antisera were incorporated in culture media growth of the homologous species was inhibited, but not growth of heterologous species.

In suggesting a classification and nomenclature of the pleuropneumonia group of organisms (J. gen. Microbiol. 1956, 14, 197) Dr. Freundt and I aimed at simplicity. We felt that we were only at the beginning of systematic study of this group. We considered that it was easier in the first place to recognise only one genus and a limited number of species. If future investigations justified it new genera would be set up and species split off later. It would be more convenient to do this than to find later the need to retract and to reduce that status of a genus or species. For these reasons an organism was not assigned to a different species unless it differed from others not only in antigenic structure, but significantly in its other biological properties. Although there are no clear rules as to the differences which should exist between organisms to justify their separation into different species, most bacteriologists would not favour a repetition of the practice amongst the Salmonella.

The organisms causing contagious pleuropneumonia in cattle and in goats differ little from each other in their biological properties, apart from antigenicity. In regard to two properties, namely, the ability of filtrates of old

cultures to discolour erythrocytes and the ability to liquefy inspissated serum, they differ from all other known organisms in the genus Mycoplasma. It was for this reason that the caprine organism was regarded as a variety of the species M. mycoides and in my opinion sufficient evidence has not yet accumulated to justify its establishment as a separate species.

Yours faithfully,

D.G. ff. Edward

Copy: Dr. E.A. Freundt."

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THE PRESENT STATUS OF INSECT VIRUS NOMENCLATURE AND CLASSIFICATION

Report of Insect Virus Study Group
of the Subcommittee on Viruses

The Insect Virus Study Group was, from the time of its formation in 1950, in favor of the binomial system of nomenclature. There are several good reasons for this, such as the well defined morphology, the formation of different kinds of inclusion bodies, the differences in chemical composition, the serological specificity, the affinity for certain tissues, the great number of host-specific insect viruses, etc. These characteristic properties, which are quite similar to the eight criteria established in Rio de Janeiro in 1950, have encouraged several attempts to name and classify insect viruses (Steinhaus 1949 and 1953, Bergold 1943, Zhdanov 1953, Weiser 1958, and Vago 1958). In general these systems, applying Linnaean binomials, have proved quite adequate and satisfactory in the past and most likely will in the future too. Naturally, the members of our study group are fully aware that increased knowledge will necessitate changes in our system. They suggest that every investigator should feel responsible to check whether a "new" insect virus is similar or identical to a virus already described, before a new name is proposed.

The Insect Virus Study Group belongs to The Virus Subcommittee of the International Committee on Bacteriological Nomenclature. Since the formation of the Study Group in 1950 it has consistently tried to conform with the decisions of the study groups of other viruses. At the last meeting of The Virus Subcommittee in Stockholm in August 1958, The Animal Virus Study Group agreed to use the "-virus" suffix for the group name (Herpesvirus, Enterovirus, Myxovirus), without using specific (group member) names and authors' names for the time being. The Plant Virus Study Group agreed to attempt to group plant viruses, and if Latinized names are given to such groups they should be formed on the "Myxovirus" model in accordance with the proposals accepted at the Rome Congress (Andrewes 1959).

By a vote of four to one[1] the members of the Insect Virus

[1]Dr. K. M. Smith is of the opinion that it is premature to apply the Linnaean system of nomenclature to insect viruses.

Study Group also agreed to use the "-virus" suffix at the end of the genus name, but in combination with a species' name as well as the author's name. The undersigned (Bergold, et al.) feel justified in this, because the main groups of genera of insect viruses are fairly distinct and there are indications that species among the groups can be characterized and distinguished. Naturally, certain changes will be necessary from time to time.

In various publications, several authors have already used the well established genus and species' names with authors, although not yet in conjunction with the "-virus" suffix. Since the genus name is now changed by the addition of the suffix, it becomes necessary to put the present author's name in parenthesis.

The Insect Virus Study Group has taken no position on Weiser's names (Weiser 1958) because their validity or appropriateness requires further study. However, some of Weiser's proposed names may be found useful and accepted in the future.

At present, the following genus names with their type species are therefore proposed:

Borrelina Paillot 1926 =

Borrelinavirus (nom. nov. Bergold, et al.) causing nuclear polyhedrosis in larvae or pupae of Lepidoptera and Hymenoptera, characterized by the presence of water insoluble polyhedron-shaped inclusions of about 0.5-15μ in diameter (polyhedral bodies) in the nuclei of infected host cells. The virus particles occurring in numbers within the inclusion bodies are mostly rod-shaped with dimensions of about 20-70 x 200-700mμ, containing only desoxyribonucleic acid and are surrounded by two membranes (Steinhaus 1949b and Bergold 1953).

Type: Borrelina bombycis Paillot 1926 =
Borrelinavirus bombycis (Paillot) comb. nov. Bergold, et al.

Bergoldia Steinhaus 1949a =

Bergoldiavirus (comb. nov. Bergold et al.) causing granulosis in larvae or pupae of Lepidoptera characterized by the presence of water insoluble ellipsoidal or irregular shaped inclusion bodies (capsules, granules) of less than 1μ length in the cytoplasm and possibly the nucleus of infected host cells. The virus particles,

occurring singly within the inclusion body are mostly rod-shaped, often slightly curved with dimensions of about 30-100 x 200-400mμ containing only desoxyribonucleic acid and are surrounded by two membranes (Steinhaus 1949a and Bergold 1953).

Type: Bergoldia calypta Steinhaus 1949a = Bergoldiavirus calyptum (Steinhaus) comb. nov. Bergold et al.

Smithia Bergold 1953 =

Smithiavirus (comb. nov. Bergold et al.) causing cytoplasmic polyhedrosis in larvae or pupae of Lepitoptera characterized by the presence of polyhedral shaped inclusions of about 0.5-15μ in diameter in the cytoplasm of infected host cells. The virus particles are mostly spherical with a diameter of about 65 mμ containing only ribonucleic acids and possibly without distinct surrounding membranes (Bergold 1953).

Type: Smithia rotunda Bergold 1953 = Smithiavirus rotundum (Bergold) comb. nov. Bergold et al.

Morator Holmes 1948 =

Moratorvirus (nov. comb. Bergold et al.) causing diseases in Lepidoptera and Diptera without formation of inclusion bodies (Steinhaus 1949b).

Type: Morator nudus Wasser 1952 = Moratorvirus nudum (Wasser) comb. nov. Bergold et al.

It is suggested by the undersigned (Bergold et al.) that investigators accept the above proposal from now on if Latin names are used for insect viruses.

G.H. Bergold*, Chairman, Canada
K. Aizawa, Japan
K.M. Smith, England
E.A. Steinhaus, U.S.A.
C. Vago, France

*Present address: Instituto Venezolano de Investigaciones Cientificas, Apartado 1827 - Ministerio de Sanidad, Caracas, Venezuela.

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